640.5 J82 v. 12

THE

Journal of Home Economics

VOL. XII JANUARY, 1920 No. 1

THE PRESENT STATUS OF VITAMINES

KATHARINE BLUNT AND CHI CHE WANG[1]

University of Chicago

It is not a simple undertaking to summarize even the more important points in the recent literature on vitamines, because the subject has been developing very fast during the last few years, and parts of it are still much in debate. Not only has information been gained from laboratory research but from observations of the tragic human experience with inadequate war diets.

The material is considered under the headings of the three vitamines now recognized—fat-soluble A, present in butter fat, cod-liver oil, green leaves, etc., the absence of which results often in the eye disease xerophthalmia; water-soluble B, fairly widely distributed in plants, and necessary to prevent polyneuritis or beri-beri; and water-soluble C, the antiscorbutic vitamine. All are necessary for the best growth.

FAT-SOLUBLE A

Dr. H. Gideon Wells[2] of the Department of Pathology of the University of Chicago, who served in Roumania under the Red Cross, tells a dramatic story showing the need of this vitamine for children. The scanty diet in Roumania, when he arrived, consisted of little more than a limited amount of corn-meal and quantities of a very thin bran-vegetable soup. There was no milk nor butter, for the Austrians had driven off the cows. Many of the children had eye disease, sometimes so severe

[1] The authors wish to thank Dr. Lafayette B. Mendel and Dr. E. V. McCollum for reading this paper and making important suggestions.

[2] Personal communication.

as to cause blindness. There also was much of the distressing swollen condition known as war-edema, the latter probably due to the low calories and especially the low protein of the diet. Dr. Wells, at the height of his difficulties in getting food of any kind, learned of a vessel which had put into Archangel with cod-liver oil as its entire cargo. Through the efforts of the Red Cross all of it was sent down, and it saved the lives of many of the children. After their long fat starvation, they took readily what might have been refused under happier circumstances.

Not only xerophthalmia but rickets may be connected with lack of the fat-soluble vitamine. Work by Mellanby (1) on puppies seems to point in this direction, and possibly that of Hess and Unger (2) on the value of cod-liver oil in curing and preventing rickets in negro infants.

The need for fat-soluble A is not limited to children or young animals in general. Drummond (3), in London, has shown that as young rats approach maturity their requirement becomes markedly less. They can even live without it in apparently good health for considerable time, but sooner or later they lose weight and often have eye disease. They also show a distinct decrease in resistance to various infections, many deaths from infectious disease occurring. The older the young rats are the longer they can stand the inadequate diet before their decline. Dr. McCollum in his lectures has reported what he believes to be a similar pathological eye effect in adult human beings in certain northern lumber camps where the only fat is cured bacon and where the diet must be almost completely lacking in *A*. A condition known as "night-blindness" is prevalent—a defect of eyesight not noticed by the non-reading laborer till the dim light of night. "There is therefore every reason," says Drummond, "that great care should be taken to ensure that dietaries of adults contain an adequate supply of foodstuffs in which the fat-soluble A is present."

The fat-soluble vitamine occurs in more foods than was at first thought, but in variable quantities. Butter fat is still regarded as the most important source, but the quantity (4) therein depends upon the quantity of *A* in the feed of the cow and upon the manipulation of the butter itself. (See below in connection with stability.) Whale oil is another fairly rich source, though not so rich as butter. Drummond (5), with carefully standardized methods of feeding young rats and noting the change of weight, if any, week by week, found that he obtained about the same satisfactory growth when the fat-soluble A came wholly from 8 per cent

butter fat or 20 per cent whale oil. McCollum (6) has found even smaller amounts of butter fat entirely satisfactory—as little as 3 per cent. Fish oils in general, and fat fish may serve as valuable sources. Oleo oil, as shown by Osborne and Mendel several years ago, contains a fair amount of it, and so do oleomargarines made from oleo oil, but not the nut margarines made wholly from vegetable oils (8). However, as Steenbock (4) says, "Oleomargarines . . . . . are not to be considered in the same class as good butter in providing the organism with the fat-soluble vitamine." Pig's liver oil, and liver tissue, kidney tissue, probably glandular organs in general (9) give fair supplies—that is, that portion of the animal of which we eat little is far superior to the skeleton muscle of which we eat much.

Of the vegetable sources we know even better than formerly the value of spinach. Osborne and Mendel (10) fed rats dried spinach to the extent of 5 per cent of the diet as their only source of fat-soluble vitamine for eighty-seven and eighty-three days; then substituted the spinach by yeast, which is free from the fat-soluble vitamine, containing only the water-soluble. The rats continued to thrive for ninety-three and ninety-seven days more; that is, they had stored up enough of the fat-soluble vitamine from the spinach to last through the long period of deprivation. Cabbage is not so satisfactory. Carrots (11), although not leaves, have some fat-soluble A; peas (12) a small amount. So, too, possibly do bananas (13). Yellow corn (14) may contain sufficient amounts to allow normal growth and reproduction in the rat, but white corn is valueless as a source.

A very interesting generalization[3] has been made by Steenbock (14) about the foods which contain this vitamine: they all contain yellow coloring matter. Butter, egg yolks, cod-liver oil are obvious examples. Oleo oil, the part of the beef fat which contains the vitamine, is yellow, the solid beef fat which lacks it is colorless. Of the commercial oleo oils which he has tested, those most highly pigmented are richest in the fat-soluble vitamine. Colored roots such as carrots and sweet potatoes have it, but sugar beets, mangels, dasheens, and Irish potatoes have little or none. Spinach and grass, of course, have yellow associated with their chlorophyl. The carotin isolated by Steenbock did not serve as a substitute for the vitamine, but carotin is a very labile sub-

[3] See, however, an article by Palmer, which appeared after this paper had gone to press, in *Science*, 50, 502, (Nov. 28), 1919, and which enumerates various foods with yellow color and without *A*, and with *A* without yellow color.

stance and may have changed chemically in the process of removal. "It appears reasonably safe, at least as a working hypothesis, to assume that the fat-soluble vitamine is a yellow plant pigment or a closely related compound."

The stability of fat-soluble A is not nearly so great as has been thought. The earlier conclusion that it is stable to heat is due more probably to the fact that such large quantities of the vitamine-containing food were fed that a destruction of part of it would not be noted. Steenbock, Boutwell and Kent (4) have found that after butter fat had been heated for four hours at 100° its growth-promoting properties had largely disappeared, and after one hour at 100° they had distinctly lessened. Drummond, interested particularly in the use of hydrogenated fats as butter and lard substitutes during the fat shortage in England, has investigated the question both for whale oil and butter. The hydrogenation of the whale oil at 250° for four hours completely destroyed the *A*. Even heating at 100° for an hour had the same effect, or keeping it for eighteen days at 37° spread out exposed to air. The heat was the cause of this loss of efficiency, for shaking with oxygen at room temperature made no change. Steenbock mentions a sample of butter which showed no demonstrable amount of *A* after it had been kept three weeks unsalted in a poorly iced refrigerator. The probability of some destruction during ordinary cooking processes is thus of interest.

With cabbages (15), too, high temperatures or drying may reduce the efficiency, an hour's heating at 100°–120° having no effect on *A*, but two hours at 130° destroying it completely.

The fat-soluble vitamine therefore seems to be of even greater importance in the diet of young and old than was formerly realized, and while it is more widely distributed, it is less stable than the first investigations demonstrated, and may be even destroyed in part at temperatures used in cooking.

WATER-SOLUBLE B

For studying the water-soluble vitamine, observations have been continued on the growth of rats and on the onset of polyneuritis in pigeons and chickens. While it is not definitely proved that these two methods deal with one and the same substance, the assumption that such is the case is usually made. A new and most promising method of research has just been developed by Williams (16) in the laboratory of Physiological Chemistry of the University of Chicago. Yeast (16,

17), unlike the higher plants, cannot grow without this vitamine. Therefore if drops of different solutions each containing a single yeast cell are observed microscopically at intervals of a few hours, the growth of the yeast and the number of cells into which it has multiplied will show not only whether the solutions contain the vitamine but the relative quantities present. This method is of course much simpler and quicker than the usual feeding experiment and will probably result in a rapid increase in our knowledge of this vitamine.

Water-soluble B occurs more widely in plant than in animal foods. Milk is by no means rich in it. Osborne and Mendel (18) found it necessary to give their rats at least 16 cc. per day for normal growth. They discuss but do not explain to their satisfaction the much quoted[4] results of Hopkins who secured remarkable growth on adding as little as 2 cc. of milk to a diet on which his rats were failing. They warn against a diet of white bread and only a little milk, or against feeding infants a top milk, water, sugar mixture. Muscle tissue also is low in this vitamine, but various other animal tissues—heart, kidney, brain, and liver—are satisfactory sources of supply—a distribution similar to that of *A* (9) though somewhat wider.

An especially satisfactory statement of the occurrence of this vitamine in plants, as so far known, is given by Osborne and Mendel (19) in the *Journal of Biological Chemistry* for this past August. They list a wide variety of plant foods, including among others seeds of cereals and a number of legumes, spinach, cabbage, potatoes, and carrots; and they add to the list, from their own recent experiments, the usual edible portion of the onion, turnip, beet (leaves, stem, and root), and tomato. A goodly number of our common vegetables have thus been tested for *B* and so far without exception everyone has been found to contain it—a much wider distribution than that of *A*. The part of the cereal that is rich in it is not the bran as usually supposed, so much as the germ, which is often removed with the bran, e.g., in rice polishings. Commercial wheat bran contains more or less vitamine, according to the amount of the germ associated with it. Of one sample tested by Chick and Hume (20) five and a half times as much had to be used to cure polyneuritic pigeons as was necessary when the germ was used. Our commercial bran is especially thoroughly "skinned" when it comes from large well-equipped modern flour mills (21), and therefore is of little value to correct the deficiency of white flour and bread. Even

[4] Sherman: Food Products, 1914, p. 79.

the yeast or the milk used in the white bread does not prevent polyneuritis in pigeons (22), though the yeast delays the period of its onset. On the other hand, bread made from real graham flour is adequate. Of course these facts have important bearing upon the kind of flour most desirable from the standpoint of national nutrition. Voegtlin and Lake in a later paper (23) say, "We believe that a product which does not contain any bran but does include the germ would not possess these objectionable features [of causing intestinal disturbances], would at the same time be more nutritious and would reduce greatly the possibility of vitamine deficiency in the modern mixed diet."

Yeast (10) is distinctly the richest known source of the water-soluble vitamine, being four times as efficient as dried spinach which ranks next among a group studied quantitatively. Only half as rich as spinach are whole wheat, soy beans, dried eggs, milk solids. Cabbage, too, is not so satisfactory as spinach. Wheat germ is a valuable source, and so are navy beans and peas. Immature alfalfa clover and timothy show decided advantage over the mature (19). This variation with age may apply to plant foods in general and may mean a real nutritive superiority for young vegetables.

Like fat-soluble A, *B* is not so stable toward heat as we formerly supposed. McCollum's beans and peas (12), which, although heated for one and a quarter hours in an autoclave, still supplied all the *B* that the rat needed, were fed in large quantities, often as much as 25 per cent of the diet. When the food supplying *B* is fed in the smallest amount which will produce growth at all (24), it is found that heating above 100° does cause deterioration, and that the heated food has to be supplied in larger quantities than the raw food. For example, while wheat germ (25) heated 2 hours at 100° loses little or none of its potency, heated 40 minutes at 113° it loses one-half, and heated 2 hours at 118°–124° it may lose up to nine-tenths. These temperatures, of course, point to the safety of the water-soluble vitamine in our ordinary cooking processes, but the danger of its partial or complete destruction in commercial canning or other high pressure cooking. Tinned meat, Chick and Hume report, is devoid of this vitamine, a fact shown not only by their laboratory experiments, but by the repeated development of beriberi in the British army in the Dardanelles and Mesopotamia where the diet for a time consisted only of white bread, tinned meat, and jam.

The stability of *B* toward alkali seems to be uncertain, though here, too, according to Chick and Hume, the difficulties may be due to feed-

ing such large quantities that a destruction of half or even more during the alkali treatment would not have noticeable effect on the animals. Sullivan and Voegtlin (26) of the United States Public Health Service, who observed several years ago that chickens developed polyneuritis promptly on corn bread made with soda but not on corn bread made with salt, now report polyneuritis in cats and dogs fed meat treated with sodium carbonate till distinctly alkaline and then heated at 120° for three hours; meat heated without the alkali was still a fairly satisfactory food. Rats, however, that were fed the alkali meat lived for at least 110 days—a fact quoted by Osborne and Wakeman (27) to show, with experiments of their own, that the vitamine is more resistant to alkali than generally supposed. Daniels and McClurg (28) feeding generous quantities of navy beans, soy beans, and cabbage, found the diets entirely satisfactory even when cooked for an hour and a half with 5 per cent sodium bicarbonate. McCollum and Simmonds (29) find the *B* in wheat germ destroyed by boiling with 0.28 per cent sodium hydroxide for an hour, but Osborne and Wakeman (27) find it undiminished in yeast digested with tenth normal sodium hydroxide (slightly stronger than McCollum's) for two and a half hours, and then heated for two hours. It may be that previous extraction with ether or other removal of the fat lessens the stability of *B* (16).

What happens in the body as a result of lack of the water-soluble *B* in the diet? McCarrison (30), working in India[5] has made striking advances in answering this question. He has observed changes during life and loss in weight of organs after death in a large group of pigeons made polyneuritic by a diet of polished rice and later a group fed polished rice, butter fat to supply *A*, and onions for *C*.[6] There was little difference between the group undergoing *B* starvation and that with general vitamine starvation. The body temperature of the pigeons gradually fell from a normal average of 107°F. to 98° or 99°F., showing a marked slowing up of metabolic processes. Digestive processes were greatly impaired; the starch was largely excreted unchanged. The different organs of the body lost weight strikingly, all except the adrenals which gained—thymus most, then, in order, testicles, spleen, ovary, pancreas, heart, liver, kidneys, stomach, thyroid, brain. The testicles

[5] A fairly full abstract of the first of these papers is given in *British Medical Journal* 1, 177, (Feb.) 1919, and a briefer reference to it by Le Mer in *Jour. Amer. Med Assoc.* 73, 1381, (Nov. 1), 1919.

[6] Observe apparent contradiction here with Osborne and Mendel's work with rats, proving *B* in onions. McCarrison's pigeons became polyneuritic even more promptly in the butter-fat-onion group than on polished rice alone.

lost 93 per cent and the ovaries 69 per cent of the original weight. "Perhaps one of the most remarkable results of a dietary deficient in so-called anti-neuritic vitamine is the constant and very pronounced atrophy of the testicles in males and the similar but less pronounced atrophy of the ovary in females." Other investigators have noted similar results of vitamine starvation. Drummond found that when male rats after as short a time as 14 days on a diet adequate except for *B* were mated with females on an adequate diet no pregnancies resulted.

Such degrees of atrophy in the human subject would result in sterility in males and in amenorrhoea and sterility in females. Human observations are not lacking. McCarrison quotes Vedder as saying that beri-beric women cease to menstruate. "War amenorrhoea" (abnormal cessation of menstruation) is referred to in many recent German periodicals with alarm, attributing it in part at least to defective nutrition. In the Charité-Frauenklinik in Berlin it has been seven times more frequent than before the war.[7] In Belgium, too, many cases have been observed (31). The experience of Benedict's young men is also striking (32). These difficulties may, of course, be due to general food lack rather than to the specific deficiency in *B*.

Miscellaneous infections were very frequent among McCarrison's pigeons. The whole body was liable to be overcome by a rank growth of bacteria. There may be some similarity between this observation and the great increase in tuberculosis abroad during the war.

The whole morbid process McCarrison believes to be due to nuclear starvation of all tissue cells. "Vitamines are nuclear nourishers."

WATER-SOLUBLE C

The third vitamine now recognized is the antiscorbutic. The earlier conclusion (33) that scurvy is not a deficiency disease, but is due to constipation, has been abandoned. Its adoption probably arose from having a non-controlled milk intake in the diet of the experimental animals and therefore a slight and variable amount of the vitamine.

With this vitamine even more than with the others, human experience as well as laboratory experiments must be considered—both infantile scurvy and adult scurvy. Mild cases of the latter may merely manifest themselves in languor and depression, and severe cases in looseness and final falling out of the teeth, soreness and hemorrhages of the

[7] (*British Medical Journal*, Dec. 1, 1917, p. 734).

gums, swelling of the joints, great weakness, and finally death. Degenerative tooth changes are particularly characteristic of scurvy (34). They have been described at length in the guinea-pig and are said to be identical in the human subject.

The laboratory animal most used is the guinea pig, for rats, while they thrive better with the antiscorbutic than without it, (35) do not have scurvy. The usual experimental method, carefully worked out, is to note the smallest quantity of experimental food which will prevent the onset of scurvy in the guinea pig when added to a basal "scorbutic diet" such as oats, hay, and autoclaved milk.

Among the chief workers on the antiscorbutic vitamine are Hess in New York, Givens in New Haven and Rochester, and the group, largely women, at the Lister Institute of Preventive Medicine, London,—Harriette Chick, E. Margaret Hume, and others. The results of the latter were made the basis of the recommendations of the Food (War) Committee of the Royal Society on the prevention of scurvy in the army and navy (36). Three recent editorials (37) in the *Journal of the American Medical Association* summarize much of their work as well as that of others.

"The vitamine is present in living vegetable and animal tissues, in largest amounts in fresh fruits and green vegetables, to a less extent in root vegetables and tubers. It is present in small amount in fresh meat and milk, and has not been detected in yeast, fats, cereals, pulses" (38). It is sensitive to high temperature and destroyed "when the living tissue is disorganized by drying and other methods of preservation." Orange juice has been generally recognized as one of the best antiscorbutics; grapes are only about one tenth as satisfactory. Orange peel extract is also of value. Lime juice is poor. The "lime juice" of the eighteenth and early nineteenth century which was responsible for the disappearance of scurvy from the British navy was really lemon juice from the Mediterranean countries. In 1875 certain vessels on polar exploration changed from the old "lime juice" to the true west Indian lime, and scurvy broke out again with great severity. The Lister Institute work has shown that fresh lemon juice has about four times the value of fresh lime juice as an antiscorbutic and that preserved lime juice is almost valueless.

Of the vegetables (39), often more readily available than the fruit and cheaper, raw cabbage is even better than orange juice, and the raw juices of swede (a kind of turnip), beetroot, and carrots are of service.

Cooking (40), however, diminishes or entirely destroys their efficiency except when the vegetables (carrots) are young (Hess). Cabbage (15) cooked for one hour at 60° or twenty minutes at 90° to 100° lost about 70 per cent of its antiscorbutic value and for one hour at 90° more than 90 per cent. Long cooked or canned vegetables are thus of no value as antiscorbutics, a fact born out by human experience for many years. Canned tomatoes (40) seem to be an exception, possibly because of their acid and original richness in the substance. They have been successfully used as a substitute for the more expensive orange juice to prevent scurvy in infants receiving pasteurized milk (41).

Drying, too, lessens the value (42), and, still more, storage after drying. Dried vegetables and herbs have been tried in scurvy in the Army and Navy with no help. Dried tomatoes, however, Givens (43) found, still retain a significant amount of the original high antiscorbutic potency. Drying generally does least harm when done quickly at a low temperature (under diminished pressure) and when the vegetables dried are young. Dried beans, themselves valueless, develop their vitamine on sprouting (44). The Food (War) Committee of the Royal Society recommends (36) that when other antiscorbutics are not available the beans be sprouted and the sprouts used. Their therapeutic value was strikingly shown when King's College Hospital, London, with a number of mild cases of scurvy in soldiers from Serbia, divided its patients into two groups, treating thirty in one ward with 4 ounces of fresh lemon juice daily and twenty-seven in another with 4 ounces of dried haricot beans freshly germinated. Of the patients on the lemon juice 53.4 per cent were cured within four weeks and of those on the germinated beans 70.4 per cent (45).

Potatoes contain the vitamine if not cooked too long, but as the only antiscorbutic the ration must be as much as fourteen ounces per man per day (36). In Glascow (46), recently, a poor law hospital which had apparently been depending largely on potatoes and had been near the danger line with a normal of three cases of scurvy a year, developed fifty cases when the lack of potatoes in the fall and winter of 1916–17 caused the substitution of the potatoes by rice and bread. In this country, too, Hess (47) speaks of the development of scurvy in numerous institutions in the spring of 1916 after an exceptionally poor potato crop the previous year. In one there were more than twenty deaths, in another more than two hundred diagnosed cases and probably many latent cases which escaped observation.

Milk (48) is of only moderate value as an antiscorbutic and loses most of the value when pasteurized or boiled. Commercial condensed milk (49) is valueless and so, too, is dried milk unless the drying is done very quickly, e.g., for a few seconds at 116° (Hess and Unger) (50). Numerous observations have been made of infantile scurvy developing from use of pasteurized milk and its check by the addition of orange juice. In this connection should be mentioned a very valuable summary, though without the work of the last two years—Morse's "A Résumé of the Literature of Infantile Scurvy during the Past Five Years" in the *Boston Medical and Surgical Journal* (51). An editorial in the *Journal of the American Medical Association* (52) cites numerous recent distressing cases of infantile scurvy abroad, for instance, in Prague in 1917–18 when the much desired "raw" milk was often of doubtful "rawness," oranges had disappeared from the markets since early in the war, and other fruits and even most green vegetables were difficult to obtain and usually very expensive.

Fresh meat has so little antiscorbutic value that the Royal Society (36) states that as much as two to four pounds daily are necessary if it is to be used as the chief preventive agent, and tinned meat is completely valueless. Dutcher, Pierson, and Biester (53) find practically none even in raw beef. Their laboratory experiments do not confirm Stefánsson's remarkable report (54) of his polar experiences. His habit, and that of his party in the north, was to live almost wholly on seal meat and bear meat, using not only the muscle tissue, but liver and various other organs. Often they consumed raw frozen liver. They had no cases of scurvy on this diet. However, three men, who were separated at times from the main party and depended largely on some cached foods which they had found—flour, salt pork, butter, honey, sugar, pilot bread, preserved fruit, pemmican, meat extract, dried fruit, rice, beans, and peas—developed serious scurvy. They were promptly cured when fed meat, largely raw.

One more human scurvy experience (55) illustrates a number of the points so far stated. A number of camps of the South African Native Labour Corps were established in France during the war. The rations consisted of 1 pound frozen or preserved meat, 8 ounces fresh vegetables, and definite quantities of mealy meal (corn) or rice, bread, coffee, sugar, salt, margarine, and tobacco. In country depots where they could pick extra fruit (apples) no scurvy occurred, but in a camp when this was impossible 40 per cent of the natives at one time showed symptoms of scurvy. The

half pound of fresh vegetables probably allowed no margin for the reduction of the antiscorbutic, and yet all foods had been cooked for at least three hours. The chief part of the cure was to give lemon juice, increase the supply of vegetables and limit their cooking to forty-five minutes. In a camp where the scurvy was most severe and lasted longest it was discovered that the instruction to shorten the cooking period had been disobeyed. The condition was soon improved when the cooking was reduced to forty minutes.

In conclusion, it is plain that remarkable as are the advances in the subject, we still have far to go for anything approaching complete knowledge. We need more *quantitative* information as to the distribution of the vitamines in foods and their resistance to all sorts of manipulations—cooking, storing, aging. We lack knowledge of the quantities advisable for human beings of different ages. Finally, and most fundamentally, we yet await the isolation of the substances themselves in purity and the establishment of their chemical composition.

It is very difficult to say what is the importance to the average individual of giving thought to these three vitamines in choosing the diet. Most of us probably use milk or leaf vegetables (McCollum's "protection foods") to get an adequate supply of *A*, enough vegetables of all kinds and whole cereals to get *B* and enough uncooked or little cooked foods for *C*. But the occasional moderately well-to-do individual with dietary idiosyncracies, many persons on very limited incomes, and many in institutions must be close to the danger line. Probably *C* with its marked unstability to heating or drying is the most often low in quantity, and *A* with its limited distribution second. It is more than probable, too, that all sorts of common languors and inefficiencies, and susceptibilities to many miscellaneous infections, are connected with shortage in vitamines.

BIBLIOGRAPHY

(1) Mellanby, E.: Rickets. *Lancet*, London, 407 (Mar. 15) 1919.

(2) Hess, A. F., and Unger, L. J.: Prophylactic therapy for rickets in a negro community. *Jour. Amer. Med. Assoc.*, 69, 1583, 1917.

(3) Drummond, J. C.: Researches on the fat-soluble accessory substance. II. Observation on its rôle in nutrition and influence on fat metabolism. *Biochem. Jour.*, 13, 95, (May), 1919.

(4) Steenbock, H., Boutwell, P. W., and Kent, Hazel, E.: Fat-soluble vitamine I. *Jour. Biol. Chem.*, 35, 517, 1918.

(5) Drummond, J. C.: Researches on the fat-soluble accessory substance. I. Observations upon its nature and properties. *Biochem. Jour.*, 13, 81, (May), 1919.

(6) McCollum, E. V., Simmonds, N., and Parsons, H. T.: The dietary properties of the potato. *Jour. Biol Chem.*, 36, 197, 1918.

(7) Drummond, J. C.: The nutritive value of certain fish. *Jour. Physiol.*, 52, 95, 1918.

(8) Halliburton, W. D., and Drummond, J. C.: The nutritive value of margarines and butter substitutes with reference to their content of fat-soluble accessory growth substance. *Jour. Physiol.*, 51, 235, 1917.

(9) Osborne, T. B., and Mendel, L. B.: Nutritive factors in animal tissues. II. *Jour. Biol. Chem.*, 34, 17, 1918.

(10) Osborne, T. B., and Mendel, L. B.: The vitamines in green foods. *Jour. Biol. Chem.*, 37, 187, 1919.

(11) Denton, M. C., and Kohman, E.: Feeding experiments with raw and boiled carrots. *Jour. Biol. Chem.*, 36, 249, 1918.

(12) McCollum, E. V., Simmonds, N., and Parsons, H. T.: The dietary properties of the pea. *Jour. Biol. Chem.*, 37, 287, 1919.

(13) Sugiura, K., and Benedict, S. R.: The nutritive value of the banana. *Jour. Biol. Chem.*, 36, 171, 1918.

(14) Steenbock, H.: White corn vs. yellow corn and a probable relation between the fat-soluble vitamine and yellow plant pigments. *Science*, 50, 352 (Oct. 10), 1919.

(15) Delf, E. M.: The antiscorbutic value of cabbage. I. *Biochem. Jour.*, 12, 416, 1918.

(16) Williams, R. J.: The vitamine requirement of yeast. *Jour. Biol. Chem.*, 38, 465, 1919.

(17) Bachmann, F. M.: Vitamine requirements of certain yeasts. *Jour. Biol. Chem.*, 39, 235 (Sept.), 1919.

(18) Osborne, T. B., Mendel, L. B., Ferry, E. L., and Wakeman, A. J.: Milk as a source of water-soluble vitamine. *Jour. Biol. Chem.*, 34, 537, 1918.

(19) Osborne, T. B., and Mendel, L. B.: Nutritive factors in plant tissue. *Jour. Biol. Chem.*, 39, 29 (Aug.), 1919.

(20) Chick, H., and Hume, E. M.: The distribution in wheat, rice and maize grains of the substance, the deficiency of which in a diet cause polyneuritis in birds and beri-beri in man. *Proc. Roy. Soc.*, 90B, 44, 1917.

(21) Briggs, C. H.: The digestibility of the branny coats of wheat. *Science*, 50, 427, 1919.

(22) Voegtlin, C., Lake, G. C., and Myers, C. N.: The dietary deficiency of cereal foods with reference to their content in "antineuritic vitamine." *U. S. Pub. Health Repts.*, 33, 647, 1918.

(23) Voegtlin, C., and Myers, C. N.: Distribution of the antineuritic vitamine in wheat and corn kernel. *Amer. Jour. Physiol.*, 48, 504 (May), 1919.

(24) Chick, H., and Hume, E. M.: Note on the importance of accurate and quantitative measurements in experimental work on nutrition and accessory food factors. *Jour. Biol. Chem.*, 39, 203 (Sept.), 1919.

(25) Chick, H., and Hume, E. M.: Effect of exposure of temperature at or above 100° C. upon the substance (vitamine) whose deficiency in a diet causes polyneuritis in birds and beri-beri in man. *Proc. Roy. Soc.*, 90B, 60, 1917.

(26) Sullivan, M. X., Voegtlin, C.: The distribution in foods of the so-called vitamines and their isolation. *Proc. Soc. Biol. Chem., Jour. Biol. Chem.*, 24, XVI, 1916.

(27) Osborne, T. B., Wakeman, A. J., and Ferry, E. L.: Preparation of protein free from water-soluble vitamine. *Jour. Biol. Chem.*, 39, 35 (Aug.), 1919.

(28) Daniels, A. L., and McClurg, N. I.: Influence of high temperatures and dilute alkalies on the antineuritic properties of foods. *Jour. Biol. Chem.*, 37, 201, 1919.

(29) McCollum, E. V., and Simmonds, N.: A study of the dietary essential, water-soluble B, in relation to its solubility and stability towards reagents. *Jour. Biol. Chem.*, 33, 55, 1918.

(30) McCarrison, R.: The pathogenesis of deficiency disease. *Indian Jour. Med. Research*, 6, 275 (Jan.), 1919; ibid., 6, 550 (Apr.), 1919.
(31) Belgian letter: *Jour. Amer. Med. Assoc.*, 73, 1228 (Oct. 18), 1919.
(32) Miles, W. R.: The sex expression of men living on a lowered nutritional level. *Jour. Nervous and Mental Diseases*, 49, 208 (Mar.), 1919.
(33) McCollum, E. V., and Pitz, W.: The "vitamine" hypothesis and deficiency diseases. *Jour. Biol. Chem.*, 31, 229, 1917.
(34) Zilva, S. S., and Wells, F. M.: Changes in the teeth of the guinea-pig on a scorbutic diet. *Proc. Roy. Soc.*, 90B, 505, 1919.
(35) Harden, A., and Zilva, S. S.: Accessory factors in nutrition of the rat. *Biochem. Jour.*, 12, 408, 1918.
(36) Memorandum on food and scurvy by the food (war) committee of the Royal Society. *Lancet*, London, 756 (Nov. 30), 1919.
(37) Editorial, Antiscorbutics. I. *Jour. Amer. Med. Assoc.*, 73, 271 (July 26), 1919; Antiscorbutics. II. ibid, 73, 338 (Aug. 2), 1919; Scurvy in animals. ibid, 73, 1288 (Oct. 25), 1919.
(38) Chick, H., Hume, E. M., Skelton, R. F., and Smith, A.: The relative content of antiscorbutic principle in limes and lemons. *Lancet*, London, 735 (Nov. 30), 1918.
(39) Chick, H., and Rhodes, M.: An investigation of the antiscorbutic value of the raw juices of root vegetables. *Lancet*, London, 774 (Dec. 7), 1918.
(40) Hess, A. F., and Unger, L. J.: The scurvy of guinea-pigs. III. The effect of age, heat and reaction on antiscorbutic foods. *Jour. Biol. Chem.*, 38, 293, 1919.
(41) Hess, A. F., and Unger, L. J.: Canned tomatoes as an antiscorbutic. *Proc. Soc. Exp. Biol. Med.*, 16, 1, 1918.
(42) Delf, E. M., and Skelton, R. F.: Antiscorbutic value of cabbage. II. *Biochem. Jour.*, 12, 448, 1918.
(43) Givens, M. H., and McCluggage, H. B.: The antiscorbutic property of vegetables. I. An experimental study of raw and dried tomatoes. *Jour. Biol. Chem.*, 37, 253, 1919.
(44) Chick, H., and Delf, E. M.: The antiscorbutic value of dry and germinated seeds. *Biochem. Jour.*, 13, 199 (July), 1919.
(45) Wiltshire, H. W.: Value of germinated beans in the treatment of scurvy. *Lancet*, London, 811 (Dec. 14), 1918.
(46) Editorial, Recent cases of scurvy in Glascow. *Brit. Med. Jour.*, 2, 28 (July 7), 1917.
(47) Hess, A. F.: Rôle of antiscorbutics in our dietary. *Jour. Amer. Med. Assoc.*, 71, 941, 1918.
(48) Chick, H., Hume, E. M., and Skelton, R. F.: An estimate of the antiscorbutic value of milk in infant feeding. *Lancet*, London, 1 (Jan. 5), 1918.
(49) Hart, E. B., Steenbock, H., Smith, D. W.: Studies of experimental scurvy. *Jour. Biol. Chem.*, 38, 305 (June), 1919.
(50) Hess, A. F., and Unger, L. J.: The scurvy of guinea pigs. III. The effect of age, heat and reaction on antiscorbutic foods. *Jour. Biol. Chem.*, 38, 293, 1919.
(51) Morse, J. L.: Progress in pediatrics. A résumé of the literature of infantile scurvy during the past 5 years. *Boston Med. Surg. Jour.*, 178, 160, 1918.
(52) Editorial, Child welfare and disease under war-time food conditions in Central Europe. *Jour. Amer. Med. Assoc.*, 72, 939, 1919.
(53) Dutcher, R. A., Pierson, E. M., and Biester, A.: The antiscorbutic properties of raw lean beef. *Science*, 50, 184 (Aug. 22), 1919.
(54) Stefánsson, V.: Observations on three cases of scurvy. *Jour. Amer. Med. Assoc.*, 71, 1715, 1918.
(55) Dyke, H. W.: Outbreak of scurvy in the South African Native Labour Corps. *Lancet*, London, 513 (Oct. 19), 1918.

RECENT ADVANCES IN OUR KNOWLEDGE OF FOOD SELECTION AND PREPARATION

MABEL T. WELLMAN

Indiana University

While much of the work on food reported in the last few months has already appeared in the JOURNAL OF HOME ECONOMICS—much especially of that relating to food preparation—still a great deal of interesting information, sometimes in regard to the cooking of foods, sometimes in regard to food selection, is to be gleaned from studies of nutrition, published in more technical journals. The Science Section of the American Home Economics Association has made an excellent start in the collection and publication of the experimental work going on in the various universities and colleges, thereby filling an evident need and giving an immense impetus to further experimentation.

In the following account, material from all sources is summarized from the standpoint of a special food or food principle, so that the results of various investigations may be related or compared.

Bread. The question of the most economical way to use our wheat supply, emphasized by war conditions, has led to various studies. A bulletin[1] from the United States Department of Agriculture shows the effect of bran in lowering the coefficient of digestibility of an ordinary mixed diet. Bran bread made by the following recipe was fed, each subject eating almost a pound a day. Bran bread: 15 c. bran, $3\frac{3}{4}$ tsp. soda, $1\frac{7}{8}$ c. molasses, $3\frac{3}{4}$ tsp. salt, 5 tsp. ginger, 1 scant c. lard, $1\frac{7}{8}$ qts. hot water.

Both coarse and fine bran was used. The reduction in the coefficient of digestibility obtained is shown as follows:

	PROTEIN	FAT	CARBOHYDRATE
	per cent	*per cent*	*per cent*
Ordinary mixed diet	92	95	97
Diet with coarse bran	35.8	93.1	82.8
Diet with fine bran	37	88.5	79.8

During the tests the amounts of feces were greater than usual whether the subjects were active, athletic, or sedentary in habit, some finding

[1] Experiments on the Digestibility of Wheat Bran in a Diet Without Wheat Flour. A. B. Holmes, *Bulletin* 751.

the bran decidedly laxative. Little difference was noted between fine and coarse bran so far as its laxative effect was concerned. Osborne and Mendel with coworkers[2] state that, except in special cases, "little can be gained by including bran and wheat embryo in the flour when this is used under conditions prevailing in this country." By the last part of the statement they mean that the danger of vitamine deficiency due to too restricted a use of highly milled flour is not a menace, with the food habits of our people. They add that "the by-products of milling will be better utilized on the farm than on the table. Moreover, since "about 80 per cent of the wheat kernel can be so improved in nutritive value by adding animal products to the diet that a much smaller amount of the flour will satisfy the protein needs of nutrition, it may well be that the use of the by-products of milling for the production of meat, milk, or eggs will result in a greater economy in the use of flour than if these were used directly for human food."

Meanwhile a report[3] from London includes figures for the digestibility of bread made with wheat flour of 80 and of 90 per cent extraction, and concludes that "breads made with 90 per cent flour are not so completely utilized as those made from 80 per cent flour, since when they are used as part of an ordinary mixed diet the coefficient of digestibility of the entire diet was 94.5 per cent, in comparison with 96.4 per cent when breads made with 80 per cent extraction were used. The coefficient of digestibility for the nitrogenous constituents of the diet in the case of the former is 87.3 per cent and the latter 89.4 per cent. The observations indicate that bread made of 90 per cent extraction had no ill effects upon health and will mean a gain in food value for every 100 lbs. of wheat of 13,000 total calories and 1.56 lbs. of protein."

In connection with this report, another from a French source[4] is of interest. The workers examined microscopically both bread and the feces recovered after feeding bread to mouse, dog, and man, and obtained results that apparently show that the cell walls of the aleurone granules are broken in the bread and that the contents are digested. They suggest that during kneading and fermentation the cell walls are broken

[2] The Nutritive Value of the Wheat Kernel and its Milling Products. *Jour. Biol. Chem.*, 37, pp. 557–601.

[3] Report by the Food (War) Committee of the Royal Society on the Digestibility of Breads. Abstracted in *Exp. Sta. Record*, 40, p. 657.

[4] Digestion of the Aleurone Cells Incorporated in Bread. Lapique and Liacre, *Compt. Rend. Soc. Biol.* (Paris), 81, pp. 217–222.

PUBLIC LIBRARY
DETROIT, MICH.

open at points weakened by milling, exposing the contents to the action of the digestive juices.

Along an entirely different line are some experiments conducted in the physical laboratory of the University of Washington.[5] It was determined in three separate tests that bread baked in pans of different materials was much more readily burned in certain materials than in others. The bread baked in granite burned most easily; that in other materials in the order listed: Russian iron, tin, pyrex glass, aluminum (unpolished), aluminum (polished). The oven temperatures were carefully controlled.

Vegetables. Much work on vegetables has been reported, some in regard to food value and the effect of cooking on food value, the rest on problems connected with canning.

The theory that vegetables and fruits must be considered necessary to well-being, on the ground that they balance the acid-forming substances in meat, cereals, and certain other foods, seems to be disproved. Lamb and Evvard,[6] as a result of work on pigs, think "the apparent failure for experimental diets previously tried may be attributed to other causes not wholly excluded." They find that excess of mineral acid did not cause a significant loss of calcium, nor did it interfere with storage of protein. This work agrees with that reported by McClendon[7] and others, from which they conclude that there is no foundation for the view that the alkaline reserve of man is endangered by the acid-forming diets, but that such diets as usually eaten by man are deficient in antiscorbutic vitamines.

Osborne and Mendel[8] have investigated the relative efficiency of foods as antiscorbutics, and conclude that dried spinach is twice as effective as whole wheat, soy beans, dried eggs, or milk solids, but that dried yeast is four times as efficient as the spinach. Delf[9] finds that the long cooking of cabbage at a low temperature is more destructive of the antiscorbutic vitamine than short cooking at a high temperature, and points out the disadvantage of the use of the fireless cooker for such vegetables as cabbage and green vegetables. He also finds that such vegetables preserve their antiscorbutic property better if steamed

[5] Bread Baking in Pans of Different Materials. Work done by Frances Heverlo. *Jour. Home Econ.*, 11, p. 352.

[6] The Acid-Base Balance in Animal Nutrition. *Jour. Biol. Chem.*, 37, pp. 317–342.

[7] Effect of Diet on the Alkaline Reserve of the Blood. *Jour. Biol. Chem.*, 38, pp. 539–548.

[8] Vitamines in Green Foods. *Jour. Biol. Chem.*, 37, pp. 187–200.

[9] The Antiscorbutic Value of Cabbage. *Biochem. Jour.*, 12, pp. 411–447.

rather than boiled, and believes that if they are boiled the addition of either acid or alkali will increase the loss of antiscorbutic properties. The fat-soluble vitamines seem to show greater stability when exposed to heat. Continuing the work, Delf and Skelton[10] find that cabbage dried at 60°C. and stored two or three weeks at ordinary room temperature, has lost 95 per cent of its antiscorbutic property, while at the end of 3 months it has lost nearly all of it. Plunging the cabbage into boiling water before drying distinctly increases the amount of antiscorbutic material retained after drying. Drying and storing for two months also resulted in the loss of 86 per cent of the fat-soluble factor.

Hess and Unger[11] declare that in dehydration "too much attention has been paid to the degree of the heating process and too little to the more important factors—the age of the vegetables, their freshness previous to dehydration, and their manner of preservation." In another article[12], entitled the Scurvy of Guinea Pigs, the same authors find that, while 35 grams of old carrots was sufficient to protect a guinea pig from scurvy when used raw, after three quarters of an hour cooking that amount was insufficient, but when the test was repeated with freshly plucked carrots, 35 grams of the cooked carrots was sufficient for protection.

In the same article the authors call attention to the value of canned tomatoes as a substitute for orange juice in infant feeding, though boiling the tomatoes diminished somewhat the antiscorbutic potency.

Helen Masters[13] concludes that the best way to cook dry legumes, especially on a larger scale, is to soak them for at least four hours in water containing 1 per cent of sodium bicarbonate; then either steam them or boil them for about an hour in water containing 0.25 per cent salt.

Daniels and McClurg[14] warn us that "The fact that our animals made normal growth on rations in which the liquor from the cooked beans was the only source of the water-soluble vitamine emphasized again the undesirability of discarding the water surrounding cooked or canned vegetables. This contains not only much of the inorganic con-

[10] *Biochem. Jour.*, 12, pp. 448–463.

[11] Factors Affecting the Antiscorbutic Value of Foods. *Amer. Jour. Diseases Children*, 17, pp. 221–240.

[12] *Jour. Biol. Chem.*, 38, pp. 293–304.

[13] An Investigation of Methods Employed of Cooking Vegetables with Special Reference to the Losses Incurred. *Biochem. Jour.*, 12, pp. 231–247.

[14] Antineuritic Properties of Foods. *Jour. Biol. Chem.*, 37, pp. 210–213.

stituents of the vegetables, the soluble carbohydrates, and proteins, but obviously much of the water-soluble food accessory as well."

There seems to be a difference of opinion in regard to the possible dangers which may arise from the use of canned foods. Daniels and McClurg continue in the article quoted above, "The note of warning sounded by Chick and Hume to the effect that grave danger may attend the use of large amounts of tinned goods, we believe is unfounded, at least from the standpoint of the antineuritic vitamine contents of the food. From our results as well as those of McCollum and coworkers, it seems improbable that in the commercial canning of foods this vitamine is destroyed to such an extent that too little will be included in the diet when the usual amount of canned food is eaten. Even if there should be a considerable increase in the amount of canned food consumed, we believe there will be still enough of the anti-neuritic vitamine to meet physiological requirements, provided the diet is not materially changed in other respects." Chick and Hume[15] reply to this disagreement with the opinion just quoted and object because the work was not performed quantitatively. They point out that no measure of the amount necessary for growth was made, nor of the exact amount offered to or eaten by the rats. They believe that the amount of anti-neuritic vitamine in the diet was so far in excess of what was necessary that it could well be reduced, halved, or even quartered by cooking and still be sufficient for maintenance. If this were true the results would not prove that the anti-neuritic vitamine was not injured by heating.

Kurk[16] describes the results of examining such vegetables as celery, lettuce, water-cress, green onions, and radishes, collected from stores that were both desirable and undesirable from the sanitary standpoint. He concludes that the general sanitary conditions of the store did not influence the bacterial count.

The JOURNAL OF HOME ECONOMICS has recently published two interesting articles on canning. One reports results from the canning of asparagus[17] and suggests, among other conclusions, the addition of small quantities of vinegar as effective in reducing the time of processing necessary for the preservation of the vegetable.

[15] Note on the Importance of Accurate and Quantitative Measurements in Experimental Work on Nutrition and Accessory Food Factors. *Jour. Biol. Chem.*, 39, p. 201.

[16] The Bacterial Examination of Green Vegetables. *Amer. Jour. Pub. Health*, 8, pp. 660–661.

[17] The Canning of Asparagus. Skinner and Glasgow, *Jour. Home Econ.*, 11, pp. 154–157.

The second article gives data on the Effect of Pack and Depth of Water Bath upon Interior Temperature of Jars in Cold Pack Canning.[18] Conclusions drawn are that the water bath should completely immerse the jars; that loosely packed jars only should be used in canning by usual home methods; that home-canned vegetables should always be heated before use to avoid the danger of poisoning by the toxin of B. botulinus, the spores of which are exceedingly resistant to heat.

The last statement refers to an article by Burke[19] in which it is reported that there is a difference in the powers of the spore to resist heat. The more resistant forms are not killed by the open-kettle method of canning, since spores will survive three and a half hours boiling and remain alive in the scum on top of the liquid even longer. Cold pack methods are also not effective in killing the spores; one period, even of five hours heating in boiling water, being insufficient for sterilization. Blanching in hot water does not materially injure the spore. Even fractional sterilization in three successive days is of doubtful value because the exposure to the temperature of the first sterilization period delays the germination of the spores so that they do not develop before the third period of sterilization. While pressure canning is the only method of sterilization that can be considered safe, a pressure of 5, 10 or even 15 pounds for ten minutes will not kill these spores. A comparatively long period must be used. It is suggested that the wisest way is to prevent contamination during the preparation of the material, since it is certain that the organisms are not present under the skin of perfectly sound fruit and vegetables that are not overripe. Bruised and partially spoiled material should never be used for canning. Fruits and vegetables should be thoroughly cleaned before cutting and hands and utensils should be clean, and flies eliminated. Each jar should be examined when opened but not tasted, since the smallest taste may be fatal if the poison is strong. There are three signs of spoilage, any one of which should cause the canned material to be suspected: (1) gas bubbles in jar, tops of jar blown and a squirt of liquid when the top is unscrewed; (2) an odor somewhat resembling rancid cheese; (3) a mushy or disintegrated appearance of the solid part of the contents.

[18] Effect of Pack and Depth of Water Bath upon Interior Temperature of Jars in Cold Pack Canning. Castle, *Jour. Home Econ.*, 11, pp. 246–251.

[19] Effect of Heat on the Spores of Bacillus Botulinus. *Jour. Amer. Med. Assoc.*, 72, pp. 88–92.

Since the toxins can be destroyed by five minutes boiling, the material heated in this way just before using may be eaten without danger, even though the spores are not killed, since the latter are not harmful in themselves. Since this organism produces toxins only in material that has been sealed in air-tight containers for a week or more, there is no danger from it when fresh fruit and vegetables are eaten. Meanwhile Dickson[20] tells us that botulism is of comparatively frequent occurrence on the Pacific coast.

Milk. In an article on the Milk Industry and the War, North[21] informs us that "to provide a milk supply that would furnish the United States with the milk required, according to the leading food chemists, would mean an increase of 20,000,000 dairy cows in the United States, or almost double the present number."

Moreover Overman[22] tells us that dairy products (milk, skim milk, cottage cheese, and American cheddar cheese) are to be regarded as among the cheapest foods of animal origin, both as to protein and total energy.

Such experiments as those of McCollum, Simmonds and Parsons[23] make clear that we should demand an increase in our milk supply. They report: "In all cases where we have attempted to correct the dietary deficiency of a seed mixture by the addition of leaf only, we have not secured results so good as with milk, especially with such amounts of leaf as would be acceptable in the human diet." Eggs do not furnish sufficient calcium. They also say: "From biological tests we now know that the proteins of pea and navy bean are worth only about half as much for growth in the rat as an equal amount of protein from one of the cereal grains, and that the latter have about one half the value for the conversion into the body proteins which can be shown for the milk protein; and again, "Both meat and eggs are more expensive sources of protection against faulty diet than milk."

There are several studies of the antiscorbutic properties of milk. Chick, Hume, and Skelton[24] find "that milk is a food poor in the antiscorbutic accessory factor, since a ration large in comparison with that of other antiscorbutic materials is necessary to afford sufficient

[20] Monograph from The Rockefeller Institute of Med. Research, No. 8, 1918.
[21] *Amer. Jour. Pub. Health*, 9, pp. 258–267.
[22] Food Values and Dairy Products. Ill. Sta. Circ. 235.
[23] A Biological Analysis of Pellagra-Producing Diets. *Jour. Biol. Chem.*, 38, pp. 113–147.
[24] The Antiscorbutic Value of Cow's Milk. *Biochem. Jour.*, 12, pp. 131–153.

protection from scurvy." They urge that in infant feeding when milk is in any way heated or dried, an additional source of antiscorbutic vitamine be provided. Hart, Steenbock, and Smith[25] find that sterilized milk, unsweetened condensed milk and milk powders seem to have largely lost their antiscorbutic properties. In this they are not in agreement with the British experience reported by the United States Public Health Service[26] in the use of milk powder in infant feeding.

Hess and Unger[27] in discussing the possible deficiency in antiscorbutic vitamine of pasteurized milk, point out that much of the antiscorbutic factor is lost subsequent to heating in the course of handling and aging, and believe that "the length of time to which it is subjected to the injurious environment is in general more important than the intensity of the process."

A suggestion that cows might be specially fed to produce antiscorbutic vitamine is interesting. Also of interest is Sugiura and Benedict's finding that a diet adequate for the production of the young and for growth after the eyes of the young open was nevertheless inadequate for proper milk production. Such a result may call for more careful feeding of the nursing mother.

Fruits. Sugiura and Benedict[28] find banana deficient in protein as well as in enough water-soluble accessory to produce either maintenance or growth in albino rats. It is interesting to find so many of the vegetable sources of protein commonly used for meat substitutes declared inadequate, but until we know more of their effectiveness in combinations we are not in a position to be sure of their place in the diet. A method of preparing banana meal is given in the Experiment Station Record[29] quoted from the *South African Journal of Industry.* The fruit is to be peeled, sliced thin with a nickel or fruit knife, and spread in wooden trays to dry in the sun. After drying, the material may be crushed in an ordinary mill or mortar and sifted through fine muslin. The meal may be used for cakes or bread by mixing with equal parts of wheat flour, or cooked into mush or used in pudding. Sweet potatoes, yams, or dasheens may all be treated in the same way.

[25] Effect of Heat on the Antiscorbutic Properties of Some Milk Products. *Jour. Biol. Chem.*, 38, pp. 305–324.

[26] *Bul. Hyg. Lab. U. S. P. H.*, No. 473.

[27] Factors Affecting the Antiscorbutic Value of Foods. *Amer. Jour. Diseases Children*, 17, pp. 221–240.

[28] Nutritive Value of Banana. *Jour. Biol. Chem.*, 36, pp. 171–189.

[29] Vol. 41, pp. 64 and 65.

Eggs. In an article[30] from the laboratory of the University of Missouri, on The Use of Desiccated Eggs, the conclusions are drawn that satisfacory desiccated egg products may now be obtained and that these even at their present price can effect a considerable saving throughout the greater part of the year, but that there is not yet sufficient demand to make them easy to obtain in retail amounts. The bacterial content is not such as to make them detrimental to health when used in cooked food. They give highly satisfactory results in practically all typical foods in which eggs are used, but can not be used in mayonnaise dressing.

The suggestion[31] that horse serum be used as an inexpensive and satisfactory substitute for white of egg in cooking is not likely to meet with much favor in this country.

Sugars and syrups. In an article on Factors Influencing the Amount of Invert Sugar in Fondant[32] Daniels and Cook draw some very interesting conclusions. They find that in regions in which the water used in cooking is even moderately hard, the alkalinity may be sufficient to neutralize the cream of tartar called for in an ordinary recipe, and believe a local recipe should be formulated for such use. They suggest, however, that it is easier to obtain constant results in making fondant if glucose is added directly to the sucrose instead of depending on the inversion of part of the latter, for they find that when acid is present the length of time of cooking influences the amount of invert sugar obtained.

In an article on the Acidity of Various Syrups Used in Cookery, Daniels and Heisig[33] determined the amount of soda to be used with various syrups and honey. This article calls our attention to the need of standardization of such recipes..

The *American Food Journal*[34] has an article by Dunnigan from Iowa State College on sugar substitutes in jelly making, and an article by Rucke[35] of the University of Illinois on the manufacture of Invert Sugar and Use of Substitutes, both of which may prove useful during

[30] The Use of Desiccated Eggs. Lhamon, *Jour. Home Econ.*, 11, pp. 108–115.

[31] Utilization of Horse Serum in Human Nutrition. *Compt. Rend. Acad. Agr. France*, No. 29, pp. 807–810.

[32] *Jour. Home Econ.*, 11, pp. 65–70.

[33] *Jour. Home Econ.*, 11, pp. 195–200.

[34] Vol. 13, pp. 247–248.

[35] Ibid, pp. 671 and 672.

sugar shortage periods. In the latter the suggestion is made that a syrup made by inverting cane sugar has greater sweetening power than the original sugar. A definite formula, although for large scale use, is given.

Water. McCollum, et al.[36] find that "the most important inorganic deficiency in seeds, tubers, and meat mixtures is calcium, and this is so pronounced that we are of the opinion that even in these human dietaries in which such calcium-rich foods as milk are used in fair liberality, the intake of calcium must be below the optimum, and that the direct addition of this element in the form of carbonate or lactate might be of distinct benefit in human nutrition, except perhaps in those regions where the water is unusually rich in calcium salts." This may prove a comforting suggestion to those living in hard-water regions who have questioned the healthfulness of the drinking water.

Fats. Starling[37] discusses the significance of fats in the diet and points out that while there is strictly speaking no evidence of a physiological minimum of fat required, practically a certain amount is necessary, because if the deficiency in fat is made up by carbohydrate the diet lacks staying power, is too bulky, and is more subject to fermentative changes in the intestines. From statistical data given, it is concluded that fat should supply from 20 to 25 per cent of the total energy of the diet, but that this amount may be diminished without serious detriment to health, though probably not without inconvenience and lessened efficiency, and may be increased without interfering with either health or efficiency.

There are three studies on the digestibility of fats to report. One by Blunt and Mallon[38] was undertaken to determine the digestibility of bacon fat—to test the discrepancy between Rubner's figures and those published in the United States Department of Agriculture, Bulletin No. 310 and in the *Journal of Biological Chemistry*, vol. 23, p. 505. The coefficient was found to average 96.7 per cent but was slightly lower for lightly cooked and slightly higher for much cooked bacon. On the whole it approximated the coefficient of digestibility of any other soft fat. In a bulletin on the Digestibility of Certain Miscellaneous Animal Fats, Holmes[39] reports work undertaken to determine the digesti-

[36] A Biological Analysis of Pellagra-Producing Diets. *Jour. Biol. Chem.*, 38, pp. 113–147.
[37] *British Med. Jour.*, No. 3005, pp. 165–170. Rev. in *Exp. Sta. Rec.*, 40, p. 170.
[38] *Jour. Biol. Chem.*, 38, pp. 43–48.
[39] *U. S. Dept. Agr. Bul.* No. 613.

bility of the oleo oil used in oleomargarine and of the oleo-stearin used in miscellaneous shortening fats. He finds that, when eaten in amounts equivalent to the amount of butter used in the normal dietary, either fat is well assimilated, and should prove a wholesome source of fat for human consumption.

A second bulletin[40] by the same author is of interest because it suggests the use of oil from sources not commonly considered as commercially possible. He calls our attention to the estimate made in 1908 that as a by-product of peach and apricot kernels in California alone it would be possible to produce 210 to 420 tons of peach kernel oil, and 350 to 400 tons of apricot kernel oil, while in 1917 it was estimated that as a by-product of the tomatoes used for pulping processes such as catsup, it would be possible to produce 343 tons of tomato seed oil. Holmes finds all the oils, as well as oil from cherry pits and melon seeds, well assimilated and of nutritive value equal to such better known products as cotton seed and olive oils.

Morgan and Cozens[41] report work done at the University of California on fat absorption in frying. They conclude that there is a considerable variation in the amount of fat absorbed by a standard dough mixture, fried at a constant temperature for a fixed length of time. Using a recipe almost identical with that used by M. C. McKee (Fat Absorption in Frying Doughnuts. *Jour. Home Econ.*, vol. 10, pp. 18–20), they find the fat averaging 17.4 per cent, while Miss McKee found 34.7 per cent, and the government figure for doughnuts bought at bakeries is 21 per cent. They do not find that a slight difference of temperature, 205° instead of 210°C., makes any difference in the fat absorbed, nor do their results uphold the claims of relatively lower fat absorption for the proprietary fats.

[40] Digestibility of Some By-product Oils. *U. S. Dept. Agr. Bul.* No. 781.

[41] Changes in the Physical and Chemical Constants of Fats used for Frying a Standard Dough. *Jour. Home Econ.*, 11, pp. 394–412.

AN EXPERIMENT IN SOCIALIZING HOME ECONOMICS EDUCATION

EMMA A. WINSLOW

Secretary, Committee on Home Economics of the New York Charity Organization Society, and Lecturer, Teachers College, Columbia University

How can home economics students be brought into closer touch with real life problems? How can they be made to realize more fully the individual and social importance of home economics education? How can they be made to see more definitely the close relationship between organized social work and home economics work? How can they be influenced to think of home economics as a social science and one with social responsibilities?

An attempt to answer these questions was made during the month of June by the Committee on Home Economics of the New York Charity Organization Society through its Sub-committee on Student Plans of which Miss Cora M. Winchell is Chairman. A special field work course was offered to properly qualified women with home economics training, and over forty applications were received although the dates of the course (June 9 to July 5) interfered with the attendance of students or staff members from the many schools and colleges whose academic year ends late in June. The size of the group was originally limited to twenty-five, but thirty applicants were finally accepted and twenty-six of them completed the course. Only five of these were without professional experience, and the majority of the group had had a considerable amount either as teachers, extension workers, or dietitians.

On Wednesday of each week the group heard talks by social workers and visited social agencies. On Saturday there was a round table discussion. On Monday, Tuesday, Thursday, and Friday the students were divided into groups of two or three, and each group was assigned to a special field work supervisor who gave each student individual training in the methods and principles of social case work and a considerable amount of experience in case work practice. The field work supervisors were district secretaries in the New York Charity Organization Society and the Brooklyn Bureau of Charities, and the students were given full responsibility as members of the staff of these organizations during their training period and their work was expected to measure up to the standards set for good social case work. The

particular tasks varied according to the capability of the student and the particular needs of the families under care, but usually the student was assigned to work with a small group of families presenting various types of social problems, and was guided in making different kinds of investigations and developing various constructive plans of treatment.

A surprising thing to several of the students was the fact that not all people tell "the truth and nothing but the truth;" and that there is real need for the verification of essential kinds of information. They also learned the importance of searching for underlying causes rather than treating superficial difficulties, and came to realize the difficulty of securing good results in educational work in home economics when the main cause for low living standards is the payment of inadequate wages or the lack of community responsibility for providing the essentials for wholesome living. In addition they learned to appreciate the value of the methods and technique which have been gradually developed in social work, and the importance of utilizing certain of them in any social work in home economics.

They also came to realize very forcibly how many families are not reached by the domestic science work in the upper grades of the elementary schools and how much need there is for developing more opportunities for people to receive instruction in simple homemaking practices, especially in foreign districts where people are unfamiliar with desirable housekeeping methods under American living conditions.

Of greatest value, perhaps, especially in connection with home economics work, was the realization which came to practically all of the students of the importance of thinking of the influence of various social and economic problems, and of the various forms of organized social work, in the terms of their effect on individual family life. Why girls go wrong, why men desert their families, why vocational training is necessary, why certain racial groups do not mix easily here in America, the evils of unemployment, the long-standing effects of illness, what happens when the cost of living goes up and the wage remains stationary,—these and many other questions became of absorbing interest to various members of the group when viewed from the standpoint of what was happening in a family in which they were vitally interested. The efficiency or the deficiency in the work of various types of social agencies became matters of considerable importance in a definite and personal way when considered in connection with the development of plans for the lessening of the difficulties encountered in a particular family.

Each student kept a diary record of all work done, and the academic result for the course which was given by Teachers College, Columbia University, was based on this record and the grades recommended to the Committee on Instruction by the Committee in charge of the work.

The course was too short to be of value as vocational training for social work positions, and this was not the purpose for which it was established. It is felt, however, that it proved itself of distinct value as a means of bringing students into close contact with actual home problems as seen by the social worker, and that it also brought them into close contact with the many and varied efforts required for the solution of these problems. It also seems to have had the very great value of strengthening the belief of this group of home economics women in the social value of the subject in which they are chiefly interested.

THE TRAINING OF CHILDREN AS A PART OF LABORATORY WORK IN HOME MANAGEMENT

ELIZABETH VERMILYE

The University of Minnesota

Under the provisions of the Smith-Hughes act, universities engaged in training teachers of the vocation of homemaking are required to provide for their students "vocational contact." That is, if these students are ultimately to teach the vocation of homemaking, it is obviously necessary that they must themselves have experience with that vocation. The value of home experience has been well demonstrated, but it is likewise well known that in too many cases girls in their mothers' homes are never given full responsibility, so that they have not had complete contact with their vocation.

Obviously the college girl cannot be provided with the identical experience of the average homemaker. She has neither the situation nor the time. The thing which the colleges and universities can do is to put her into contact, not with the actual situation of the homemaker responsible for the welfare of her family, but with as many home problems as possible, and with those problems grouped together in such a fashion as to provide the nearest semblance to the task of the homemaker.

At the present time there are, to our knowledge, eighteen colleges and universities in the country offering laboratory work in home management. Up to this time, however, the most important work of the household, the work around which the average household centers, has been omitted—the care and training of children. The time has now come when it seems feasible to make an application in the home management house of the subject matter gained in child welfare courses.

The following is an explanation of the project undertaken in the spring and summer quarters of 1918–19 at the University of Minnesota.

The University of Minnesota conducts two home management houses in connection with its Division of Home Economics. Under the project for adding the training of children to the course, a child was taken into each house, the entire care being placed in the hands of the students, under the supervision of the instructor.

THE PROBLEM

The Object. The work was undertaken (1) to show that laboratory work in the care of children can be fitted into a college program; (2) to demonstrate methods of child care, both physical and mental, which are known to result in the well-being and development of the child; and (3) to work out some management problems involved in the care of children.

The babies. The children were two boys, Russell, aged thirteen months, and Earl, aged twenty-one months. Both had been in baby homes since birth. They were taken because they were two for whom the arrangements could be made easily. The coöperation of the home authorities was easily secured.

Coöperation of other sections and departments. Although the problem was mainly one of management, it was recognized from the beginning that the project was undertaken by the Division as a whole. Thus, the clothing section coöperated in making clothing and a clothing budget; the instructor in home nursing gave the initial demonstrations of the best methods of physical care. The Division of Pediatrics in the College of Medicine coöperated by giving the babies an examination in clinic.

Adjustment to the college program. Each girl, in rotation, carried the work of "baby manager" for one week. Toward the close of the course each girl had another period with the same responsibility. The "baby manager" assumed the entire responsibility for the care of the child

during her period. She herself did the actual work of caring for him between the hours of 6.00 to 8.00 a.m. and from 4.30 to 6.00 p.m. During the day the child was in the care of three or four other students during the time they were not in class, the manager making the program for this care, giving instructions regarding food and other matters needing attention. The baby manager did the baby's laundry work.

One difficulty in the program should be noted. There were 3 periods per week when all the students in both groups were in the same class; 3 other periods when all the students and one instructor were in the same class. In the first case the instructors took care of the children; in the latter, assistance from students not in the working group was used.

METHODS OF CARE EMPLOYED

Daily program

Russell		Earl	
Waken	6:30	Waken	6:00
Breakfast	6:30– 7:30	Breakfast	6:00– 6:00
Quiet play in crib	7:30– 8:30	Quiet play in crib	6:30– 7:30
Bath	8:30– 8:50	Bath	7:30– 8:00
Play	8:50– 9:30	Play, ride	8:00–11:00
Sleep	9:30–12:00	Dinner	11:00–12:00
Dinner	12:00– 1:00	Sleep	12:00– 3:00
Play, ride	1:00– 5:00	Play, ride	3:00– 5:00
Supper	5:00– 6:00	Supper	5:00– 6:00
Bed	6:00	Bed	6:00

Food. Russell: age thirteen months; weight 15 pounds, 9 ounces at beginning. Special dietary needs: diet to overcome rickets and eczema; liberal in quantity to correct underweight. The following shows the kinds given daily, except as noted:

Milk (skimmed), one pint.
Toast, crackers, both white and graham.
Cereal thoroughly cooked but not strained.
Fruit juice and pulp, two kinds each day, especially orange juice and prune pulp.
Potatoes, mashed or baked, served without butter.
Vegetables other than potatoes, almost any kind, especially spinach, carrots, tomatoes.
Meat in the form of scraped beef, veal, or chicken, two or three times per week or
Eggs 2 or 3 times per week or
Custards 2 or 3 times per week.
Cod liver oil, 3 tsp. per day.

Earl: age twenty-one months; weight 19 pounds, 2 ounces at beginning. Special dietary needs: diet to overcome anaemia; liberal in quantity to correct underweight. The diet for Earl was practically the same as for Russell with a few exceptions. Not having the complication of eczema he was not so closely restricted as to fat, and a little butter was used as seasoning; emphasis was placed on iron-containing varieties of fruits and vegetables; eggs were allowed two or three times a week in addition to the allowance of meat, and simple desserts were allowed daily, such as blanc mange, fruit whip, custards, gelatine.

Play. Russell, at the age of thirteen months was very inactive and apparently took notice of nothing. He was content to be in his bed and made no effort to creep or reach for things. Gradually he came to take more interest as illustrated by his desire to find articles concealed from him, to imitate expressions and sounds, and to recognize people whom he knew. Progress was shown equally in his ability to creep and attempt to take steps. The latter was accomplished by the use of his bed and pen.

Earl, at the age of twenty-one months, could walk only a few steps at a time, and did not know how to laugh or play; his muscular coördinations generally were poorly developed. A "kiddie car" was the means of teaching him to walk easily because he was so fond of pushing it about. Climbing on stairways and furniture, and turning somersaults resulted in amazing development. After being helped to walk up and down stairs a half-dozen times, he chose to stop sitting down and propelling himself with his hands and to walk "right side up" by the banisters. Development in using his hands came more slowly. Building blocks helped; baskets or metal bowls into which he could put small, light objects, such as soap boxes and talcum cans, afforded much amusement—much more than more costly special toys. His development and pleasure came from being allowed to work with things.

Not the least important part of his progress came from being loved and played with and taught the baby games. It was necessary to see that this was not overdone, but this took care of itself as the instructor and the girls became acquainted with their problem.

Discipline. This presented no particular problem in the case of Russell, who was in the creeping stage. Of a naturally happy disposition, he was pleased with any attention he received and made few protests.

With the older child who had a more nervous disposition, and who was climbing about, discipline was one of the largest problems. The principle was adopted of giving him the greatest amount of freedom compatible with reasonable care of property and convenience for the grown people. Students and instructor together worked out the specific applications, as, for instance: Earl may play with wastebaskets but must be taught to replace anything he pulls out; he may not handle books and papers from any bookshelves; he may push about the wicker furniture, but may not handle piano nor piano stool. Whenever possible, corrections were made by diverting his attention; sometimes he had to be removed bodily from the scene of trouble.

Success in the problems of discipline was demonstrated by a considerable improvement in his nervous condition effected in the first two weeks. Uniformity in granting privileges and imposing restrictions, and the prevention of over-stimulation were probably the two most important factors.

MANAGEMENT PROBLEMS

Task management, or the adjustment of work to take the least time and energy, perhaps came first. Factors in accomplishing this were:

Equipment. Outside the simplest pieces, such as crib and high chair, no special equipment was used. Working space in the bathroom was improvised with an old drawing board and pads, fitted over the end of the tub; a paper lined grape basket held toilet articles. All of this was of great interest when being arranged.

Food planning. Much of the babies' food was served from the amounts prepared for the family use. Only a few of the out-of-season vegetables were prepared separately.

Supervision of play. Russell could be left to play alone a considerable part of the time and seemed better for it. Attempts at leaving Earl entirely alone at his play resulted in disastrous bumps, or in damaged furniture. The method developed was to give him the toys which would keep him busiest and let him play alone while other work proceeded. All kinds of housework could be done but at a much slower rate than normally; sewing and mending could be done at a rate nearly normal, also the more mechanical kinds of desk work, such as copying and checking. Really concentrated study was impossible.

Time. Any figures given must be taken as approximate. In recording time, an attempt was made to separate the time when nothing could be done besides caring for the baby, and that in which the care of the baby overlapped other work.

Time given especially to the care of the babies was subdivided approximately as follows, and was about the same for both babies:

1. About three hours per day to giving meals. It must be remembered that the children were undernourished to begin with and in strange hands, and hence were somewhat capricious. Moreover, the babies' meal hours did not coincide with the family schedule as in many homes, and this meant an increase in time.
2. About one half hour per day to bath.
3. An average of about one hour to laundry.
4. About one half hour to tidying rooms, bathroom, airing beds.

Total: five hours of actual care of baby.

Aside from the above the babies spent not over four waking hours, and these at play. However, even during their sleep, someone had to assume responsibility. Including this, there was an average of about five hours work per day expended by the baby manager, and an average of one and one-third hours per day by the assistant housekeepers, though usually put in in groups of three or four hours twice a week.

It must be noted that these hours included many other activities of the students. From the manager's time should be deducted the time spent in dressing, eating breakfast and dinner, cleaning her room; also time for her personal relaxation in the evening, even though not completely free from responsibility. On the other hand the draft upon an individual which comes from assuming responsibility cannot be computed in terms of hours. It is, however, an inevitable accompaniment of homemaking.

Cost. All the large pieces of equipment were donated or loaned, including cribs, carriages, high chairs, toilet chair; also some clothing. For this reason the actual figures recorded are not significant of the actual cost of initiating such a piece of work. The figures for food, also, were extremely difficult to separate accurately, since much was served from the amounts prepared for the family. A weighed dietary study was made over a one-week period. Calculations based upon this, with allowances for waste indicated $25 as the approximate cost per quarter, twelve weeks for each child.

CONCLUSIONS

After one quarter and one summer session of child training as a part of home management work, with the opinion of four groups of students and four instructors, the following conclusions are unanimous:

1. The work is of irreplaceable value because of the joy it brings to the house and the home spirit it creates; because of the increased range of vocational contact; and because it makes the house problems more normal in their relationships.

2. The work is of decided benefit to both students and children.[1] The benefit to the babies is shown by a few facts taken from their health records:

Russell—Gain in weight in seventeen weeks, 4 pounds, 12 ounces; eczema controlled; activity greatly increased, gain in height $2\frac{3}{4}$ inches.

Earl—Gain in weight in seventeen weeks, 3 pounds, 6 ounces; activity greatly increased; muscular coördination improved; nervous irritability greatly lessened; mental development advanced.

3. The most desirable age for the babies is open to discussion. Children of four to six months of age to start with would give a wider range of problems during the year. Undoubtedly babies who could remain in the crib a large share of the time would be easier to care for under house conditions, if in good health. On the other hand, the experience with the active, developing small boy or girl presents a field all its own.

[1] The examining physician at the end of seventeen weeks summed up his opinion of the results thus: "The improvement in the condition of these children speaks highly for your coöperative motherhood."

FOR THE HOMEMAKER

COST OF LIVING[1]

FLORENCE NESBITT

Institute Instructor in Dietetics, American Red Cross

It is practically impossible to avoid the subject of family income when talking about child welfare, because it lies so close to the very root of all work for the interests of the child. If the income of the father is not enough to cover the necessities of life, does not permit a minimum normal standard of living then either mother and children are driven into industry, and home life is neglected; or else the standard is lowered, and we have bad housing, under-nourishment, and all the other hideous results of poverty.

It is a difficult thing to give any absolutely definite figures for an income below which we do not dare see families fall. These last few years, since the rise in cost of living has focused so much attention upon the subject, have, however, given us increasing confidence that we are able to make a fairly accurate estimate of this sort. When approaching the problem from different points of view, we find that our results when trying to estimate the necessary cost of a normal standard of living closely approximate each other. For example, the estimate which the Bureau of Labor based on a large volume of statistics as to what people really do with their income, differs very little from the estimates of those of us who start from exactly the opposite end, trying to define the elements of a normal standard, and then attempting to discover the cost of maintaining such a standard.

In Chicago, those who have been working on the problem recently figure that it costs approximately $1500 a year to buy the essentials for maintaining the average family of five—father, mother and three children—at what we might consider a normal standard. That means, of course, a minimum wage of about $5 a day for the working man.

[1] Reprinted from *Standards of Child Welfare.* A report of the Children's Bureau Conferences, May and June, 1919.

Last fall I made an estimate of the minimum cost of living for a self-supporting family in Cleveland. The Bureau of Labor had at that time just completed their estimate which placed the cost of living for ship builders' families at something under $1500 per year. My estimate was almost the same. I asked two managers of Cleveland factories how that compared with the wages of their men. Each one said that not more than 25 per cent of their people earned as much as that.

We are so in the habit of thinking about the rather abnormally high wages some people have received since the beginning of the war, that we jump to the conclusion that the whole body of wage earners are earning a great deal more than they are. When it really comes down to figures, we find that there are large groups of workers who have been affected very little by these raises. In the isolated communities where the war industries have not penetrated, there is no increase in wages that even begins to cope with the increased cost of living. If we could raise wages to meet the increase in the cost of living we would be on solid ground, but there has never been a time when the ordinary wage of untrained labor covered adequate living. In 1914, when the unskilled wage was about $2 a day, it took at least $75 a month to cover the every-day requirements of decent living.

So there seem only three ways out of the difficulty: The cost of living must come down; or there must be a nationalization of financial responsibility which will relieve the individual family of a portion of the cost which they must now bear; or wages must rise to cover the cost of living; so that every child may have his adequate opportunity for normal development.

TO COOK PRUNES WITHOUT HEAT OR SUGAR

Wash prunes well; throw the water away. Pour over them boiling water; let stand for three minutes. Pour this water off. Barely cover with cold water; let stand for twenty-four hours. The result will be a deliciously cooked prune with rich juice.

A CARD SYSTEM OF HOUSEHOLD ACCOUNTING

ELLA KAISER CARRUTH

For many years woman has been exhorted from the platform and from the printed page to put her housekeeping on as businesslike a basis as her husband puts his affairs. Now what is more businesslike than a card index, unless it be a check book? Why not, then, at least begin to put up a business-like appearance by using them both? And using them as a part of a "system of household accounting" certainly has the true ring of administrative efficiency!

Two cards and a check book will do as a starter for the system, although a third, fourth, or n^{th} card may be added as the zeal for detail increases. And after all of these are filled, may come the most absorbing of all—the "human interest" card. Consideration of that, the best, shall be saved till last, as the children say.

On the check book stubs are, of course, the records of any large expenditures. There too are found such items as "Cash.....$10.00."

With this latter entry the first of the cards is also concerned. On this card, with day-book rulings (see fig. 1) is recorded every cent of cash which goes into and comes out of the household purse. In the wide column to the right of the date are entered the sources of supply, followed in each case, in the first cash columns, by the amount received. On other lines in this same wide column are noted the names of articles for which cash (never checks) has been paid, the amount following in the last two cash columns. There it is in a nutshell; what has come in and what has gone out.

The "Balances" with amounts in brackets are merely partial balances. They are figured out every few days and compared with the "money in thy purse." This is an ounce of prevention which obviates serious discrepancies on the day of final reckoning at the end of the month. When that day comes, the difference between the sum of the money spent and that received should equal the amount of cash on hand.

Assuming that it does, and that recourse to a large "sundries" item has been unnecessary, the household administrator may proceed to the filling out of a general summary card. Details for the summary are culled from the check stubs and from the cash account card under various headings. Those suggested in figure 2 are of fairly general application. In considering the items from the check book, the checks drawn to "cash" should be ignored as they are accounted for on the cash card.

If the housekeeper is interested to have any sub-division on the general summary card itemized in more detail she has but to make use of one more card. Figure 3 illustrates how the details of the $50.63 spent for food in January may be shown. Various sub-headings for any of the other items will readily suggest themselves.

FIG. 1. CASH ACCOUNT CARD
January 1–31, 1919

1	Cash on hand	5	00			20	Club dues			1	00
2	Laundry				90	21	Slippers			2	00
	Toys				40		Lettuce				15
	Car fare				35	25	Theatre			4	00
3	Cream				40		Cash	10	00		
7	Dividend	10	00			27	Red Cross			2	00
	Stamps			1	00	30	Shoes			7	00
	Dishes			4	00						
19	Steak				80		Balance	(1	00)		
							Buttons				20
	Balance	(7	15)				Total	25	00	24	20
							Forward		80		

FIG. 2. SUMMARY OF HOUSEHOLD EXPENSES

1919

MONTH	FOOD	HOUSE-HOLD	PERSONAL	DRESS	ALLOWANCE		TOTAL
					J	M	
January	50.63	25.10	15.00	10.75	20.00	20.00	141.48
February							

FIG. 3. FOOD CARD

1919

MONTH	MEAT	GROCERIES	MILK	ICE	TOTAL	NUMBER MEALS SERVED
January	6.70	37.11	6.82		50.63	364
February						

And now for the human interest feature. Humanly speaking, few things are of more universal interest than meals. Next to them perhaps ranks social intercourse. And the meals eaten by the family and the social intercourse enjoyed by them individually or collectively are recorded on this fourth card.

One side is ruled to form a calendar for the current month. In each day's space three figures jotted down thus $\frac{3}{3}_{4}$ indicate exactly how many breakfasts, lunches, and dinners were served on that day. Any variation from the ordinary number is explained briefly on the back of the card. If, for instance, there were five dinners served on a given day instead of the usual four, a glance at the "social register" side of the card reveals the fact that Uncle Sam dined with the family on that day. A zero in another space is explained by the statement that the entire family dined out on that evening. This card should be very popular with those who maintain that one of the chief values of a cash account is that it forms a diary of daily events.

But it also serves, most prosaically, as a basis for computing the amount spent per person per meal. If the total number of meals served is transferred to the Food Card this computation is easily made. And, as every housekeeper knows, she must, in supplying her table, keep within the limits set by the expert dietetic statisticians, possibly modified by her own special condition and experience. Otherwise she is not a really business like administrator—not the kind her husband is at the office.

MINIMUM WAGE

The Massachusetts Minimum Wage Commission, in ordering a minimum wage of $12.50 per week for experienced women workers in the candy trade, publish the following weekly budget as necessary for a self-supporting woman:

Board and lodging	$7.00
Clothing	2.25
Laundry	.50
Carfares	.76
Doctor and dentist	.30
Church	.11
Newspapers and magazines	.18
Vacation	.40
Recreation	.30
Savings and insurance	.30
Self-improvement	.15
Incidentals	.25
	$12.50

The Commission fixed a minimum wage of $11 per week for experienced workers in the canning industry.—*Industrial News Survey.*

SHOES

The Health Division of the Bureau of Social Education of the Y. W. C. A. has begun a campaign of education in the matter of shoes. It not only hopes to prove to women and girls that the shoes ordinarily worn are not conducive to good posture, and consequently to good health, but it has enlisted the coöperation of shoe manufacturers in placing upon the market "approved" shoes. A list of the firms carrying "approved" shoes will be sent to each of the 1039 local associations in the United States.

This is particularly welcome news to the many women who have not needed to be convinced of the need of proper shoes, but who have found it exceedingly difficult to obtain comfortable ones, especially if any regard were paid to looks.

Can we criticize China?[1]

A leaflet issued by the United States Public Health Service called the "Road to Health" emphasizes the need of properly fitting shoes, and gives the following directions for the care of the feet:

Exercise the toe muscles by working the toes up and down over the edge of a thick board 30 times daily. Stand with feet parallel and somewhat apart with great toes firmly gripping the ground. Without bending the knees or moving the feet rotate the thighs outward repeatedly. This is chiefly done by strong contraction of the great muscles of the back of the thigh and seat. Improve your general health; take general exercise to strengthen your body. Bathe the feet daily. See a surgeon if these simple measures are not sufficient. The arches found in the shops will not correct flatfoot. They merely act as crutches. Hammertoe, bunion, and many other defects can be corrected by a surgeon. Painful feet may be due to infection in tooth sockets or tonsils; search for such conditions should be made. Mere flatness of the foot without pain or other deformity may be of no importance.

[1] Used by courtesy of the *War Work Bulletin*.

NOT BREAD ALONE

Menu cards have a certain fascination for most persons. They are usually full of possibilities, at least this is so of those which ordinarily come to the attention of the eating public. When a menu comes to light which is so meager as to be devoid even of possibilities, it is such a rarity that it deserves a place unto itself in the light of publicity.

One Polish widow, with four children in a family which has recently come to the Federated Charities for assistance, was asked to keep a menu of the meals which she served her family for one week. At the end of the week she handed to our worker the menu, which is copied exactly below.

Meals—3–17–'19 to 3–23–'19

Monday morning Bread with butter
dinner The same
Sopper Potatoes
Tuesday morning Ballony
dinner Cake
Sopper Potatoes
Wensday morning Downuts
Dinner Harings
Sopper Macaroni
Thursday morning Bread with lard
for dinner the same
sopper Tomatoe soup
Frieday morning Cake
Diner Bread with butter
Sopper rice
Saturday morning Bread Just
Dinner sausage
Sopper potatoes
Sunday sausage
Dinner tomatoe soup
Sopper the same

Immediately upon receipt of this information our worker requested the dietitian of the Maryland State College of Agriculture, Extension Service, who is working in conjunction with one of our district offices, to instruct this mother in the art of buying and preparing food. The Polish mother was entered in a cooking class and was taught to prepare simple and nourishing food for her family. She was given a menu to substitute for her old one, and on the list of foods which she served during the week of March 24th, 1919, were introduced oatmeal, rice, biscuits, cocoa, bean soup, prunes, lima beans and cabbage, none of which she had known how to prepare before. In the short space of one week she had been taught to prepare these foods, and, more than that, she had learned that, while there was such an organization as the Federrated Charities, and such assistance to be had as she had secured from the trained dietitian, there was no further need for serving meals consisting of "bread just."—*The Helping Hand*, The Federated Charities of Baltimore.

EFFECT OF BEATING CAKE MADE WITH DIFFERENT BAKING POWDERS

EVELYN G. HALLIDAY

The University of Chicago

From the results of their work with cakes Miller and Allen[1] concluded that the optimum time of beating was from one to two minutes and for a given recipe was dependent upon the vigor with which the beating was done. When beating was prolonged beyond the optimum time, cakes were heavy and inclined to tunnels. These results were ascribed to loss of carbon dioxide. For their work one type of phosphate baking powder was used throughout.

Some recent experiments carried out in this laboratory have shown that the optimum time of beating varies also with the type of baking powder used. For these experiments one-third of the following recipe was used: fat $\frac{1}{4}$ c., sugar $\frac{3}{4}$ c., egg 1, milk $\frac{1}{2}$ c., flour, $1\frac{1}{4}$ c., baking powder 3 t. of tartrate or phosphate or alum powder.

All ingredients were weighed and combined according to the conventional method by creaming the butter and sugar, adding beaten egg, then liquid and flour with baking powder alternately. Weighed amounts of batter were baked in muffin tins of the same size and at the same temperature. One series of cakes was baked immediately, others afterbeating one, two, three, five, and ten minutes respectively.

With all powders it was found that cakes beaten one minute had a better texture than those which were unbeaten and all were quite similar in appearance except those made with alum powder. These were a little coarser in texture than the others. When phosphate cakes were beaten longer than one minute, tartrate longer than two, heaviness began. With continued beating heaviness was more pronounced and tunnels appeared. Quite different were the results with alum powders. With these the cakes beaten ten minutes were best, and were as fine in texture as the best of the tartrate cakes.

If heaviness and tunnels are largely due to loss of carbon dioxide, the behavior of alum powders is easily explained by the fact that such powders do not act appreciably in the cold and consequently lose but little of their carbon dioxide in the process of manipulation.

[1] Miller and Allen: *Jour. Home Econ.*, 10 (1918), no. 12, p. 542.

THE END OF AN 80-HOUR DAY

A man who stayed home with the children for half a day while his wife did her Christmas shopping submits the following statistics:

Opened door for children	108 times
Closed it after them	108 times
Tied children's shoes	16 times
Number of stories read to them	21
Stopped children playing piano	19 times
Smoke rings blown to amuse them	498
Arbitrated children's quarrel	77 times
Put doll carriage out	28 times
Brought doll carriage in	28 times
Mended kiddie car	5 times
Cautioned children about crossing street	66 times
Children crossed street	66 times
Peddlers rang door bell	7 times
Toy balloons bought for children	6 times
Average life of balloon	3 min.
Dried children's tears	14 times
Assisted children to blow noses	14 times
Telephone calls answered	8
Percentage of wrong phone numbers	100 percent
Crackers issued to children	37
Slices of bread and butter served	12
Drinks of water served	9
Refused to buy candy	87 times
Questions about Santa Claus dodged	1,051

The statistician is now advertising for two nurse girls and a governess. —*Selected.*

HIGH COST OF LIVING

Among the angels—it's a shame
To tell it—prices are so dear,
They use the blown-out candle flame
To mend the ragged stars, this year!

—*Mary Carolyn Davies in A Little Freckled Person—Houghton, Mifflin Co.*

EDITORIAL

Lake Placid Conference on Group Living. Those who in past years have experienced the hospitality of the Lake Placid Club will be doubly glad to know of the proposal for another conference outlined in the following letter from Mrs. Dewey.

In response to several letters asking if the spirit of the Lake Placid Conference could not be revived and an "old time rally" be held there again, an informal meeting was called at the Riversea branch of the Club, Old Saybrook, Conn., on October 24–26, to discuss plans and possibilities. Since as a result of war conditions and labor difficulties, the country is facing a transition period with a decided trend from home to institution life, there seems urgent need to study specially problems connected with group living. One definite plan that has been suggested is the organization of a Bureau of research for institutional economics, on similar lines to the Harvard Bureau of Business Research, connected with the School of Business Administration.

It was decided to hold a conference at the Club about the middle of May and to invite several allied organizations to coöperate. It was suggested that a full day be offered to both the Institutional Economics and the American Dietetic Association when their Chairmen should preside and be responsible for their entire program; or, if they prefer, that each should select definite subjects for which one or more sessions be reserved, under their charge.

With various sectional and administrative groups, working in different parts of the country and holding meetings at stated intervals, the chief purpose of such a general meeting would be to unify results, broaden the scope of future research and avoid duplication of work.

Miss Emma H. Gunther of Teachers College was asked to act as Chairman of the general program committee, with whom allied organizations might confer in selecting definite topics. Open discussion after each subject presented would give opportunity for exchange of varied experiences on a wide range of problems.

The usual plan of the Lake Placid conference has been to hold morning and evening sessions, reserving afternoons for attractive excursions in the neighborhood. Regular meetings might cover four full days, or possibly Monday evening to Saturday morning inclusive. Those who attend could remain over two Sundays, gaining opportunity for informal interchange of ideas and

broadening acquaintance with workers who are widely scattered in different states. Because of their interest in the subject, the Club trustees offer conference members half price on both rooms and meals.

While all questions of community service will be of interest, suggestions for the program are especially asked on subjects which concentrate on present day progress in efficient living. ANNIE DEWEY.

COMMENT AND DISCUSSION

The Committee's Definition of Home Economics. The necessity for fixing the meaning of terms in any science or argument is generally recognized for the purpose of outlining its field and of preparing the way for further study and discussion. Out of this need arises the definition.

It was not until the year 1910 that an effort was made by a group of people to formulate an adequate definition of Home Economics, a complex subject which, within recent years, has come to have an important share in shaping the conditions and directing the activities of human life. The definition proposed by the Committee appointed to formulate it, and accepted by the American Home Economics Association, performed the splendid service of summing up the knowledge of the subject at that time and stating it in a convenient form for preservation and future investigation. The question now proposed is, "Is the definition of Home Economics as the Committee gave it to us an adequate one for our present needs?"

In the words of the Committee, "Home Economics, as a distinctive subject of instruction, is the study of the economic, sanitary, and esthetic aspects of food, clothing, and shelter as connected with their selection, preparation, and use by the family in the home or by other groups of people."

In reflecting on the meaning of the word "sanitary" it has seemed that it can not be regarded as furnishing a full account of the meaning which should be expressed. In itself it is only a fragment of the word which would complete the meaning. I refer to the word "hygienic." The question to be considered here is the question of the relation of sanitation to hygiene and of hygiene to sanitation. Sanitation refers to environment and is sometimes defined as "environmental hygiene,"

thus indicating that it is a division of the larger subject hygiene, which, according to Sedgwick and others, is the whole science and art of the conservation and promotion of health. It will be recalled that dietetics is also a division of the subject hygiene and deals with the individual and his perfection as affected by food and nutrition. As the definition of Home Economics now stands this phase of the food problem is not wholly included within its limits.

One other point seems worthy of consideration, namely, the sociologic aspects of the subjects enumerated. In addition to the economic, hygienic, and esthetic aspects might well come the sociologic aspects with reference to how much protection of life and property the citizen is to receive, how good shall be the living conditions of the community, and other questions intimately related to the daily life of the citizen as he is affected by food, clothing, and shelter, all of which is not merely a matter of personal hygiene, but a coöperative task of the entire community.

GRACE LINDER,
Ohio State University.

Mercantilism is the name given to a theory of trade that prevailed in the seventeenth and eighteenth centuries.

Mercantilism assumed that the strength of a nation depended upon the stores of silver and gold that it was able to accumulate and retain. It followed that imports were to be discouraged by tariff restrictions and otherwise, and exports encouraged; to the end that money might flow into rather than out of the country.

The fallacy of mercantilism consisted in regarding money alone as wealth and in not recognizing that other forms of capital have equal value.

The finances of many a home are conducted on the mercantilist theory. I have known a busy mother, for instance, to spend a couple of hours making a child's underwaist and to pride herself on having saved the thirty-five cents that the garment would have cost at the shop. Allowing fifteen cents for materials, she has exchanged her two hours' work for an equivalent of ten cents an hour. It would seem that a resourceful woman should be able to employ her time more profitably. A penny saved is not necessarily a penny earned; it may be a dollar unearned, and therefore lost.

MARY BARRON WASHBURN.

NEWS FROM THE FIELD

The Meeting of the American Home Economics Association in connection with the Department of Superintendence of the N. E. A. will be held in the Auditorium of the Eagle School at Cleveland, Ohio, on February 23 and 24.

Methods and tests applicable to home economics teaching in the high school, and the newer data on child feeding, are the three main divisions of the program.

The use of the project method in high school teaching, and applied economics in the one year home economics high school course, will be discussed under the first head.

How various tests may be used as a guide to teachers in evaluating a home economics course will be the first topic under the second group, and this will be followed by a discussion of some of the standard tests that may be applied in teaching textiles and clothing, and by an illustrated talk on economic tests for sewing in the vocational part-time schools.

A report on the field work of the Children's Bureau will precede a practical demonstration of the working of a feeding clinic for children under the general subject of child feeding. An exhibit of animals fed on different types of diet to show the effect of various foods on bodily growth and repair will emphasize the importance of proper food for children.

General discussion will follow the presentation of each division of subject matter.

The Annual Meeting of the National Society for Vocational Education will be held in Chicago, February 19 to 21, in cooperation with the Vocational Education Association of the Middle West, with headquarters at the Hotel La Salle.

The Vocational Homemaking Section will have programs Thursday and Friday mornings.

The Home Economics Section of the Michigan State Teachers Association held a morning session at the Detroit meeting last October.

Mr. Roy Barnes of the Educational Research Bureau of Detroit spoke on the Project Method and Mr. Stuart Courtis of the same Bureau talked about Educational Measures in Relation to Home Economics. The Detroit Home Economics Association had arranged for a luncheon at the Federation of Women's Clubs, the Woman's Exchange catering. Miss Mary Baldwin of Grand Rapids, Acting Chairman, presided at the afternoon meeting and Mrs. Henrietta Calvin, Bureau of Education, Washington, D. C., gave an inspiring talk.

A Round Table Discussion and business meeting followed.

The Home Economics Section of the Arkansas State Teachers Association held a meeting at Little Rock October 31, Stella Palmer of Fayetteville acting as chairman and Mrs. Marion Cole of Helena as secretary. Adelaide Baylor of the Federal Board spoke on Vocational Home Economics, answering as well the many questions that arose. The Course of Study was discussed by Mrs. Cole and by Gladys Dowell of Jonesboro. Bessie Peay of Little Rock spoke on Evening School Classes. At the following business meeting the section voted to raise a sum of money to establish a scholarship for some Arkansas girl who wishes to prepare herself to be a home economics teacher.

The Home Economics Section of the California State Teachers Association held three meetings during 1919.

At the first meeting a luncheon was given in the Red Cross Lunch Room, San Francisco. Miss Maude Murchie spoke on Vocational Education.

The program of the second meeting included The Work of a Dietitian with the A. E. F., Miss Monica Clay, Dietitian Base Hospital No. 30; Home Economics Courses in the Public School, Now and To-Morrow, Miss Florence M. La Ganke, Director of Home Economics, Oakland Public Schools.

The third meeting was a luncheon and business meeting with an attendance of 85 members. Six sections were organized: (1) home economics teachers in the elementary schools, (2) in the secondary schools, (3) extension workers and teachers under the Smith-Hughes act, (4) supervisors of teacher-training classes, (5) dietitians, (6) administrators.

Miss Florence La Ganke, the newly appointed director of home economics in the Oakland Schools, was elected president.

Budget Information Bureau. The Bureau of Home Economics in the Savings Division of the First Federal Reserve District, which includes the New England states, is organizing budget information bureaus in banks, under the direction of Miss S. Agnes Donham, assisted by Mrs. Florence A. Warner. The plan is to have a home economics worker for one or two days a week in an individual bank ready to give information on individual and family budgets and advise as to how one can increase one's margin for saving. Mrs. Warner has recently been visiting banks in Maine where the proposal has met with a very cordial welcome. In several cases the banks are assigning a special clerk to be trained in budget conference work. Miss Donham has started in Boston a budget training class for clerks in banks.

Fellowships. Applications for fellowships in the University of Chicago should be received by the Deans of the Graduate Schools on or before March 1, 1920. Information concerning graduate work in household administration may be obtained from Professor Marion Talbot.

Notes. In 1916, the late Mrs. Lizzie Merrill Palmer of Detroit provided in her will a fund for the founding, endowment, and maintenance of a school where "girls and young women shall be educated, trained, developed, aud disciplined with special reference to fitting them mentally, morally, physically, and religiously for the discharge of the functions and service of wifehood and motherhood, and the management, supervision, direction, and inspiration of homes." The trustees of the fund have wisely taken time to seek advice from many sources. They have appointed an equal number of women as co-trustees. They have studied the situation carefully and have persuaded Prof. Edna N. White, the president of the American Home Economics Association, to accept the directorship of the school as the very best person available. Miss White's resignation from Ohio State College and her entrance upon her new duties will take effect on February 1, 1920.

Margaret Gleason, a graduate of the University of Chicago with a master's degree from the University of California, has this year been appointed director of the Department of Household Arts at the College of Industrial Arts, Denton, Texas.

Up to this time there have been two directors, one for food and one for clothing, but Miss Gleason has had several years of successful teaching in both subjects. There are twenty-two teachers under her supervision. Out of the 1400 students in the college 900 are in the Household Arts Department and the total class enrollment is 1415.

A convention of delegates from national women's organizations was held in New York from the 17th to the 24th of October, following the International Conference of Women Physicians. Miss Cora Winchell and Miss Isabel Lord were asked to represent the American Home Economics Association.

At the conference on Problems of Education in Mining Towns, held under the auspices of the United States Bureau of Education at Pittsburgh, November 28 and 29, one of the topics discussed was the education of the miner's wife and daughters in homemaking.